

Chapter 12

Assessment & Intervention: Developmental Surveillance of a Child With Lead Poisoning

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Summary of Recommendations of Developmental Assessment & Intervention

1. Make long-term developmental surveillance a component of the management plan for any child with an elevated blood lead level (EBLL = one venous BLL ≥ 20 $\mu\text{g/dL}$ or 2 venous BLLs ≥ 15 $\mu\text{g/dL}$ drawn at least 90 days apart).
2. Do not base decisions regarding developmental assessment or intervention on a child's age at the time of the EBLL.
3. If referring a child for intervention services, e.g. early intervention and stimulation programs, those that involve a component on the development of parent skills are recommended.
4. Include a history of a child's EBLL in the problem list maintained in the child's medical record.
5. Do not end developmental surveillance when the child reaches 6 years of age or when his/her BLLs are reduced.
6. Be especially vigilant for emerging difficulties at critical transition points in childhood: 1st, 4th, and 6-7th grades.
7. Be alert for behaviors that might interfere with learning.
8. If neurodevelopmental problems are suspected in a child, refer for a thorough diagnostic evaluation (as opposed to a developmental screening test).
9. Be advocates for the child.

Introduction

As research has continued on the effects of lead on the neurodevelopment of children, it has become clear that there is no “safe” level of lead in the human body, especially for young children. Both prospective and retrospective studies have found a link between elevated blood lead levels (EBLLs) and cognitive and behavioral deficits in children. What has surprised researchers is the significant effects found among children with BLLs of $<10\mu\text{g/dL}$, a level that has been considered to be the low point of concern.

Among the population most at risk of lead poisoning, those who are poor and whose options for housing are often limited to buildings that are older and poorly maintained, there are often co-existing factors that have a negative impact on neurobehavioral development. In this case, the presence of lead in the body may be considered just one more onslaught to an already vulnerable child.

However, whatever the cause of the developmental delays, it is important that the risk is clear and documented so that children may receive the assistance they need in reaching their full potential.

More importantly, the fact that this is a preventable disease, that with determination and specific activities lead exposure can be prevented, makes preventing this disease, especially in an already vulnerable population, all the more important.

Effects of Lead on Cognitive Development

The effects of lead on cognitive development may or may not be apparent at the time the child’s lead poisoning is diagnosed. This fact not only makes it difficult to convey the urgency of getting environmental interventions done quickly, but it also decreases the likelihood that long-term follow-up will be maintained once the BLL decreases and the child is “cured”.

Behavioral difficulties have been noted in reports of Wisconsin children with EBLLs. In 2001, 34% of children with documented developmental screening tests were noted to have some behavioral, psychosocial, language, motor, or cognitive delays at the time the EBLL was diagnosed. Research studies have demonstrated that children with a history of lead poisoning are more likely to demonstrate similar delays, and as they grow older, the delays become more pronounced.

Meta-analyses of the results of several studies on cognitive and behavioral development note the following are associated with lead poisoning:

- ✓ An inverse association between children’s BLLs and their IQ scores
- ✓ Distractability, poor organization, a lack of persistence, and daydreaming.
- ✓ Antisocial behaviors in middle childhood
- ✓ BLLs at ages 1-3 yrs. seem to be the most predictive of later development
- ✓ It is more common to find an association between a child’s previous BLLs and their current developmental status than between their current BLL and current developmental status.

- ✓ The lag time associated from the time lead poisoning is diagnosed until the time there is evidence of neurodevelopmental effects may be due to a toxicological process in which a period of time is required for past exposure to affect the central nervous system. It is also thought that lead may primarily affect higher-order neurodevelopmental processes that are best tested at later ages.
- ✓ The neurodevelopmental problems associated with lead poisoning are persistent.

The effects of lead poisoning on cognitive development and the skills required to achieve in school settings may not be noted until the child reaches key learning points in school.

- ✓ First grade, when children are acquiring basic academic skills such as reading and arithmetic.
- ✓ Fourth grade, when applying acquired skills to new subject matter is being learned ("reading to learn" instead of "learning to read").
- ✓ Sixth-seventh grade, when higher order organizational and planning skills are needed to succeed.

Increased blood lead levels have been associated with difficulties in all three types of these skills.

There is variability in the effects of lead at various levels on different children. Because of this, it is recommended that an EBLL should be viewed as a risk factor for neurodevelopmental problems, not a diagnosis. An EBLL in a child's medical history should trigger alertness to the potential for learning and behavioral difficulties. If those difficulties arise, the treatment would not differ because the cause was lead poisoning.

Factors Affecting Risk of Developmental Effects

Children most at risk of lead poisoning are often those whose lives include other factors that may place them at risk of neurodevelopmental delays. Many of these factors are associated with poverty and include poor nutrition, poor sleep patterns, being transient, lack of regular health care, lack of cognitive stimulation, and single-parent household. In this situation, lead poisoning becomes another factor that may inhibit a child from reaching his/her full potential.

The good news about this information is that modifications in the child's environment may be able to mitigate the effects of lead poisoning. While there is no specific evidence that early intervention will prevent or diminish the effects of lead poisoning, it is reasonable to hypothesize that children whose neurodevelopmental difficulties are caused by lead poisoning would be helped by interventions that have been shown to assist children with difficulties caused by other etiologies. For those children, participation in these programs is associated with lower rates of grade retention and the need for special education.

Evidence suggests that participation in such programs is enhanced if begun prior to age 3 years, and if the program has a partnering component for developing parenting

skills. Because lead exposure is one of the multiple etiologies that can cause developmental delays, referral to such early intervention programs becomes an important piece of case management or medical management of a child with lead poisoning. It may benefit the child to have a referral to such programs even if no delays are noted at the present time.

Reduction of Blood Lead Levels and Developmental Effects

Decreasing the blood lead level as quickly as possible decreases the length of time a child's central nervous system is exposed to the toxin of lead. For blood lead levels $\geq 45 \mu\text{g/dL}$, chelation should be implemented as soon as the child can be situated in a lead-safe environment. While chelation at blood lead levels $< 45 \mu\text{g/dL}$ reduces the blood lead level, it has not been shown to have an impact on ameliorating the central nervous system effects of lead.

Limiting the duration of exposure, and lowering the blood lead level, may mitigate the neurodevelopmental effects. It is important that the family, property owner, and risk assessor understand the importance of reducing lead exposure in the shortest time possible. It is the role of public health to facilitate quick remediation of identified lead hazards. Actions to accomplish this include short-term deadlines for lead hazard reduction, utilizing available enforcement mechanisms, and leveraging local funding sources (including lending institutions, CDBG, and other housing resources) to correct the lead hazards as they are discovered.

Analysis of Wisconsin data of children with diagnostic BLLs between $20\text{--}40 \mu\text{g/dL}$ has shown that it takes, on average, about 4 years for the BLL to drop to below $10 \mu\text{g/dL}$. A more rapid decline in the child's BLL was noted if lead hazard reduction work was completed on the child's residence within 6 months. This indicates that shorter due dates for ordered lead hazard reduction work can benefit the EBLL child.

Developmental Surveillance as a Long-Term Health Intervention

Developmental surveillance should become a component of any health care plan for a child with a history of lead poisoning. It is important that neurodevelopmental surveillance, along with referral for diagnostic assessment if appropriate, be integrated in the overall management plan for the child. This allows for inclusion of other risk factors for developmental delays as the child grows, as well as his/her adaptation to new experiences (such as school). The primary health care provider should place the lead poisoning history among the diagnoses retained on the child's medical problem list, and it should be included and highlighted in any referrals made.

The child's lowered blood lead level, or decreased exposure to lead hazards, should not be used as an indicator that developmental surveillance is no longer necessary. Because of the lag time associated with the neurotoxic effects of lead, it is more likely that symptoms may not be noted at the time the child's blood lead level is elevated.

The health care provider should be alert to any current or developing behaviors that may interfere with learning and advocate for the child to receive the appropriate developmental assessment and supportive services. This may result in a multi-disciplinary team being involved to identify delays and needed services. This team needs coordination, and the family will need explanation and leadership in guiding them through the process. Financial assistance may also be required to obtain the services that are needed. Assistance in this area may be available through the Wisconsin Children With Special Health Care Needs Program and referral centers. Contact the Wisconsin First Step Hotline (800-642-7837) or <http://www.mch-hotlines.org> for more information.

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